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Amendments to the Claims

Sub
C1
B1

1.(currently amended) A memory system, comprising:
a hard disk, ~~wherein the hard disk must be spun to be accessed;~~
a cache memory, wherein the cache memory is comprised of a non-
volatile ferroelectric memory;
a memory controller, operable to:
determine if a memory request received by the memory system can
be satisfied by accessing the cache memory;
queue up the memory request ~~requests~~ if the memory request
cannot be satisfied by the cache memory; and
execute the memory request ~~requests~~ queued up when the hard
disk is accessed.

2.(original) The system of claim 1, wherein the cache memory further
comprises a polymer ferroelectric memory.

3.(original) The system of claim 1, wherein the memory controller further
comprises a digital signal processor.

4.(original) The system of claim 1, wherein the memory controller further
comprises an application specific integrated circuit.

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5.(original) The system of claim 1, wherein the memory controller further comprises software running on a host processor.

6.(original) The system of claim 1, wherein the memory controller resides coincident with the cache memory.

7.(original) The system of claim 1, wherein the memory controller resides separately from both the cache memory and the hard disk.

8.(currently amended) A method of processing memory requests, the method comprising:

receiving a request for a memory operation;

determining if data for the memory operation ~~already~~ exists in a ferroelectric cache memory;

~~performing a cache memory operation, if the data already exists in the~~
cache;

if the data does not ~~already~~ exist in the ferroelectric cache memory:

accessing a hard disk that contains the data for the ~~memory~~
request;

~~performing a disk memory operation;~~ and

performing any queued up disk memory operations.

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9. (previously amended) The method of claim 8, wherein the memory operation is a read operation.

10. (previously amended) The method of claim 8, wherein accessing a hard disk further comprises spinning up the hard disk.

11. (previously amended) The method of claim 10, the method further comprising spinning down the hard disk after performing any queued up disk memory operations.

12. (currently amended) The method of claim 8, wherein if the data does not already exist in the ferroelectric cache memory, the method further comprising:

determining if the request is part of a sequential stream;

if request is part of a sequential stream, deallocating cache lines in the cache memory and prefetching new cache lines;

if request is not part of a sequential stream, determine if prefetch is desirable; and

if prefetch is desirable, prefetch data.

13. (previously amended) The method of claim 12, wherein the prefetch is queued up as a disk memory operation.

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14. (previously amended) The method of claim 8, wherein performing any queued up disk memory operations further comprises determining if the queued up disk memory operations are desirable and then performing the queued up disk memory operations that are desirable.

15. (previously amended) The method of claim 8, wherein the memory operation is a write operation.

16. (currently amended) The method of claim 8, ~~wherein the cache operation further comprises~~ comprising writing data into the cache if the data exists in the ferroelectric cache memory.

17. (currently amended) The method of claim 16, ~~wherein the cache operation further comprises~~ comprising queuing up a disk memory operation, ~~wherein the disk memory operation will transfer~~ and transferring the data to the disk from the ferroelectric cache memory after the accessing the hard disk.

18. (currently amended) The method of claim 8-17, wherein the queued up disk memory operations are periodically reviewed to ensure their continued desirability.

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19. (currently amended) The method of claim 8, further comprising performing a disk memory operation if the data does not exist in the ferroelectric cache memory and wherein the disk memory operation further comprises writing data to the disk.

20. (currently amended) The method of claim 8, wherein the queued up disk memory operations include writing data from the ferroelectric cache memory to the hard disk.

21. (currently amended) A method of performing a read memory operation, the method comprising:

receiving a read request;

determining if data to satisfy the read request is located in the a ferroelectric cache;

satisfying the read request from data in the ferroelectric cache, if the data is located in the ferroelectric cache;

if the data is not located in the ferroelectric cache, performing a disk read operation, wherein the disk read operation comprises:

accessing the a disk;

allocating a new cache line;

transferring data from the disk to the new cache line; and

satisfying the read request.

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22. (currently amended) The method of claim 21, wherein accessing the a disk further comprises spinning up a hard disk.
23. (previously amended) The method of claim 22, wherein the method further comprises spinning down the hard disk after satisfying the request.
24. (previously amended) The method of claim 21, wherein the disk read operation further comprises:
- determining if the data transferred from the disk to the new cache line is part of a sequential stream;
 - if the data is part of a sequential stream, prefetching new cache lines;
 - if the data is not part of a sequential stream, determining if prefetch is desirable; and
 - if prefetching is desirable, performing a prefetch.
25. (currently amended) The method of claim 24 21, wherein prefetching further comprises queuing up a prefetch operation to be executed during a next disk memory operation.

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26. (currently amended) A method of performing a write memory request, the method comprising:
receiving a write request;
determining if at least one line in the a ferroelectric cache is associated with the write request;
if at least one line in the ferroelectric cache is associated with the write request, performing a cache write to the line; and
if no lines in the ferroelectric cache are associated with the write request, performing a new write operation.

27. (currently amended) The method of claim 26, wherein the new write operation further comprises:
allocating a new cache line;
writing data from the write request to the line allocated; and
queuing up a disk write operation, wherein the disk write operation will transfer the new data from the ferroelectric cache to a disk in a later disk memory operation.

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28. (currently amended) An apparatus comprising:
~~a storage device; and~~
a non-volatile polymer ferroelectric cache memory coupled to the a
storage device.
29. (currently amended) The apparatus of claim 28 further comprising a
controller coupled to the non-volatile polymer ferroelectric cache to queue a
memory request and wherein the storage device includes a part capable of
moving.
30. (currently amended) The apparatus of claim 29 ~~further comprising:~~
~~a controller coupled to the non-volatile cache memory to queue up input-~~
~~output requests~~ wherein the controller queues the memory request while the part
is not moving.
31. (currently amended) The apparatus of claim 29 wherein the
controller is adapted to ~~perform the queued up input-output requests~~ queue the
memory request while the part is not moving.
32. (previously amended) The apparatus of claim 29 wherein the
controller comprises software.

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33. (currently amended) The apparatus of claim 32 wherein the apparatus further comprises a general-purpose processor coupled to the non-volatile polymer ferroelectric cache memory, and the software comprises a driver for execution by the general-purpose processor.

34. (previously amended) The apparatus of claim 28 wherein the apparatus comprises a system selected from the group comprising a personal computer, a server, a workstation, a router, a switch, and a network appliance, a handheld computer, an instant messaging device, a pager and a mobile telephone.

35. (previously amended) The apparatus of claim 30 wherein the controller comprises a hardware controller device.

36. (previously amended) The apparatus of claim 28 wherein the storage device comprises a rotating storage device.

37. (previously amended) The apparatus of claim 36 wherein the rotating storage device comprises a hard disk drive.

Claim 38 and 39(cancelled)

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40. (Currently amended) An apparatus comprising:
a rotating storage device;
a non-volatile ferroelectric cache memory coupled to the rotating storage device; and
a controller coupled to the cache memory and ~~including~~ capable of :
~~means for queue~~ queuing first access requests directed to the rotating storage device;
~~means for~~ spinning up the rotating storage device in response to second access requests; and
~~means for~~ completing the queued first access requests after the rotating storage device is spun up.

41. (previously amended) The apparatus of claim 40 wherein the first access requests comprise write requests.

42. (previously amended) The apparatus of claim 41 wherein the second access requests comprise read requests.

43. (currently amended) The apparatus of claim 42 wherein the read requests comprise read requests for which there is a miss by the non-volatile ferroelectric cache memory.

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44. (previously amended) The apparatus of claim 41 wherein the first access requests further comprise prefetches.

45. (currently amended) The apparatus of claim 44 wherein the read requests comprise read requests for which there is a miss by the non-volatile ferroelectric cache memory.

46. (currently amended) A method of operating a system which includes a rotating storage device, the method comprising:
spinning down the rotating storage device;
receiving a first access request directed to the storage device;
queuing up the first access request using a ferroelectric memory;
receiving a second access request directed to the storage device;
in response to receiving the second access request, spinning up the rotating storage device; and
servicing the second access request.

47. (previously amended) The method of claim 46 further comprising:
servicing the first access request.

48. (currently amended) The method of claim 47 wherein ~~the system further includes a cache coupled to the rotating storage device, and the second access request comprises a read request that misses the cache.~~

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49. (previously amended) The method of claim 47 wherein the servicing of the first access request is performed after the servicing of the second access request.

50. (previously amended) The method of claim 49 wherein the second access request comprises a read request.

51. (currently amended) The method of claim 50 ^{wherein} ~~wherein the system further includes a cache, and the~~ queuing up the first access request comprises recording the first access request in the cache.

52.(newly added) A method, comprising:
writing data from a non-volatile cache memory to store in a disk memory in response to a cache read miss.

53.(newly added) The method of claim 52, further comprising reviewing the data in the non-volatile cache memory to determine if the data is desirable to store in the disk memory.

54.(newly added) The method of claim 52, wherein the writing comprises writing the data from a non-volatile polymer ferroelectric cache memory to the disk memory in response to the cache read miss.

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55.(newly added) A method, comprising:

writing data from a polymer ferroelectric cache memory to a disk memory.

56.(newly added) The method of claim 55, wherein the writing comprises writing the data from the polymer ferroelectric cache memory to the disk memory in response to cache read miss and after receiving a write request.

57.(newly added) The method of claim 55, further comprises:
receiving at least two write requests prior to the writing; and
writing data associated with the at least two write requests to the disk memory from the polymer ferroelectric cache memory after a cache read miss.

58.(newly added) A method, comprising:
receiving at least two write requests to write data to a disk memory; and
writing the data associated with the at least two write requests to the disk memory in response to a cache read miss.

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59.(newly added) The method of claim 58, further comprising:
storing the data associated with the at least two write requests in a non-volatile polymer ferroelectric cache memory prior to the writing.

60.(newly added) The method of claim 59, wherein the at least two write requests are received when the disk memory is spun down, and further comprising spinning up the disk memory in response to the cache read miss.

61.(newly added) A method, comprising:
queuing all write requests to write data to a disk memory using a non-volatile memory if the disk memory is spun down.

62.(newly added) The method of claim 61, wherein queuing comprises queuing all the write requests using a non-volatile polymer ferroelectric cache memory if the disk memory is spun down.

63.(newly added) The method of claim 61, further comprising:
spinning up the disk memory in response to a cache read miss; and
writing the data associated with all the write requests to the disk memory after the cache read miss.

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64.(newly added) A method, comprising:
spinning up a disk memory only in response to a cache read miss.

65.(newly added) The method of claim 64, further comprising
transferring data from a polymer ferroelectric cache memory to the disk memory
in response to the cache read miss.

66.(newly added) A method, comprising:
prefetching data from a disk memory to a polymer ferroelectric memory.

67.(newly added) The method of claim 66, wherein the prefetching
includes prefetching the data from the disk memory to a polymer ferroelectric
cache memory only in response to a cache read miss.

68.(newly added) The method of claim 67, further comprising spinning
up the disk memory in response to the cache read miss prior to the prefetching.

69.(newly added) The method of claim 66, further comprising queuing
prefetches if the disk memory is spun down.

70.(newly added) A method, comprising:
caching data associated with a multimedia sequential stream in a
ferroelectric memory.

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71.(newly added) The method of claim 70, wherein the data is stored in a disk memory prior to the caching, and wherein the caching comprises transferring the data from the disk memory to the ferroelectric memory.

72.(newly added) The method of claim 71, wherein the transferring includes transferring the data from the disk memory to the ferroelectric memory in response to a cache read miss.